U.S. DEPARTMENT OF AGRICULTURE FOREST PEST LEAFLET 62
Forest Service September 1961

Comandra Blister Rust

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Comandra blister rust is a disease of hard pines. The causal fungus *Cronartium comandrae* Pk. is native to North America, where it has been known for more than 80 years. The disease is most common in Western United States, where it is destructive in ponderosa and lodgepole pines. It is rare in the southern pine region, but in the East, Table-Mountain pine is sometimes heavily attacked.

Distribution

The general range of comandra blister rust is from New Brunswick to the Yukon and British Columbia in Canada, and southward to northern Mississippi, New Mexico, and California in the United States. In Western United States the fungus is present in all the States from the Rocky Mountains to the Pacific Ocean, but is most common in California, Idaho, Montana, Utah, and Wyoming.

Hosts

Comandra blister rust has been reported on the following pines: Arizona, Austrian, jack, loblolly, lodgepole, maritime, pitch, ponderosa, Scotch, and Table-Mountain. The relative susceptibility of these pines is not precisely known, but field evidence indicates that ponderosa and lodgepole pines are highly susceptible. Jack pine is attacked over a large part of its range.

Besides these pines, the fungus attacks the alternate host plants *Comandra umbellata* (L.) Nutt. and *C. livida* Richards, commonly known as false or bastard toadflax or as comandra. The former (fig. 1) is by far the more common in Western United States. A marked distinguishing characteristic of the plant is the deep blue color of the cortex of the rhizomes, which rapidly intensifies on exposed cut or broken surfaces.

Life History

Cronartium comandrae has a life history very similar to that of the well-known white pine blister rust (*C. ribicola*). The fungus grows perennially in the living bark of pines, and it develops annually on the alternate host plant, where it may be found on both sides of the leaves and on stems.

The fungus infects pines during late summer and fall, probably through the needles. About 2 or 3 years after initial infection, drops of a thick, somewhat sticky and reddish-orange liquid begin to exude from this diseased bark during

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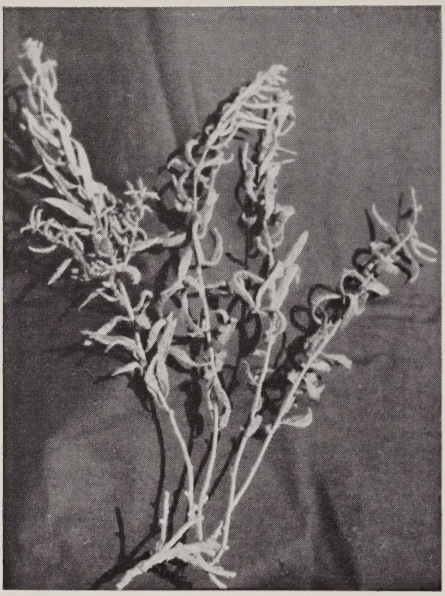

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Figure 1.—False or bastard toadflax *(Comandra umbellata)* bearing telia of comandra blister rust. These rather inconspicuous plants are usually between 6 and 8 inches high. Only a small part of the rhizome, from which the vertical stems rise, is shown.

the summer. These drops contain pycniospores that probably function in the sexual phase of reproduction of the fungus. In the growing season of the year following the appearance of the pycnial drops, whitish-colored spore sacs called aecia (fig. 2) are produced over the area previously occupied by the pycnia.

These sacs, or blisters, break when mature and release great numbers of orange-colored aeciospores, which are disseminated by wind to infect the alternate host plants. The main period of aeciospore production begins in spring; aeciospore production continues at a reduced rate throughout the summer and into fall.

About 10 days following aeciospore infection of the comandra plants, yellowish blisterlike spots (uredia) about the size of a pinhead appear on the leaves. Yellow urediospores are soon produced in these spots. These spores can infect only other comandra plants, not pines. This is the repeating stage of the rust and serves to intensify the rust on the alternate host. Several generations of the urediospore stage may be produced during a single summer if moisture conditions are favorable.

About 15 days after uredia appear on the comandra plants, brownish hairlike structures called telia begin to develop from the area of the uredial pustules. Telia grow to nearly one-tenth inch in length and are composed of columnar masses of teliospores held together in a gelatinous matrix. In time, under favorable moisture conditions, each teliospore germinates in place and upon germination produces four tiny basidiospores.

The basidiospores, which are airborne, are the only spores that can infect pines. Pine infection usually occurs in late summer or fall, and completes the life cycle of the fungus.

Moisture is needed for germination of all spore types produced by the fungus and the subsequent infection of either host. Moist growing seasons, therefore, favor spread and intensification of comandra rust, but dry seasons retard it. Since weather conditions favorable to each successive spore stage occur only in occasional years, heavy pine infection also occurs only in occasional "wave" years.

Symptoms

The first conspicuous indication of the disease on the pine host is a spindle-shaped swelling of the bark (fig. 3). Cankers originate on needle-bearing twigs and stems. The swelling, a thickening of the bark, is caused by a concentration of the fungus mycelium in the tissues. The diseased bark is not noticeably discolored.

The reddish-orange pycnial drops which appear 2 or 3 years after initial infection, somewhat resemble resin drops and vary considerably in size; the largest are about three-eighths of an inch in diameter. They are easily washed away by rains and thus often escape notice.

During spring or early summer of the year following the appearance of the pycnia and over the area they occupied, the aecia push through the bark as whitish blisters or sacs. When fully developed, the sacs rupture and reveal masses of orange aeciospores.

Cankered bark on which aecia were produced is very cracked and pitted (fig. 3), and the cracks extend to the cambium. In time, branches and stems are girdled. Following death of the parts beyond the canker, the foliage thereon turns first a yellowish and later a reddish-brown color. The dead parts, with the colored foliage still attached, are known as "flags," and are the most conspicuous symptom of the comandra rust until dead trees appear in infected timber stands.

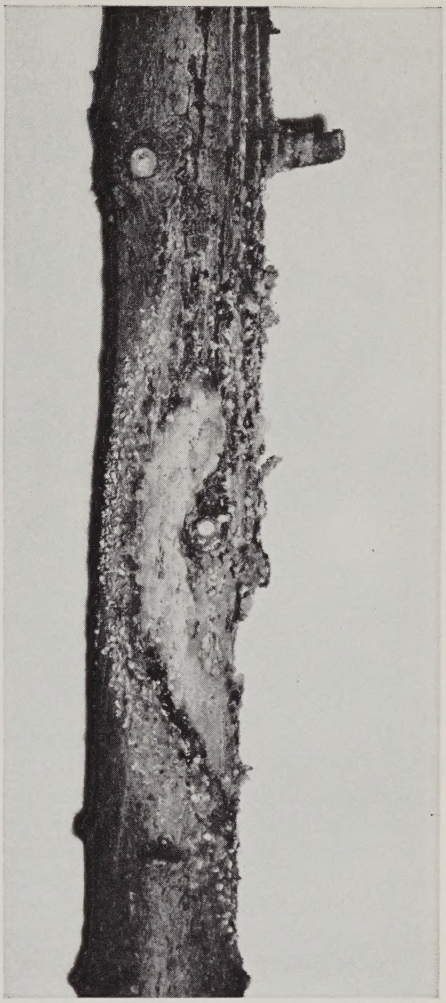

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Figure 2.—An aecia-bearing comandra blister rust canker on lodgepole pine. Aecia are the small whitish blisters appearing here over a zone surrounding the area where bark has been removed by rodents.

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Figure 3.—Typical spindle-shaped comandra rust canker on the trunk of a small lodgepole pine. The origin of this canker is traceable to the older and conspicuous branch canker from which the fungus spread through the branch to the trunk. Note the characteristic cracking and pitting of bark on swollen areas.

When cankers develop on the main stem or trunk of large and mature trees the bark is usually constricted instead of swollen. Aecia are seldom produced on such cankers on lodgepole pine, probably because the bark is thick. On ponderosa pine, aeciospores may be found on large trunk cankers under bark scales, especially around branch bases.

Resin usually exudes abundantly from diseased lodgepole pine bark, dries, accumulates, and often turns yellow. These yellowish, very pitchy trunk cankers are another conspicuous symptom of the rust, especially on lodgepole pine (fig. 4).

Resin exudation is a less-marked characteristic of trunk cankers on ponderosa pine. However, the flow of resin often increases as a result of wounds inflicted by rodents, particularly porcupines, which commonly feed on the infected bark (fig. 5). Such rodent activity is reason to strongly suspect the presence of the disease.

Although not a symptom, a microscopic characteristic of the comandra rust fungus that readily distinguishes it from all other rusts on pines is the pear shape of the aeciospores. The smaller pycniospores also have the same general shape.

Damage

Comandra blister rust damage in a pine stand usually is not spectacular. The rust attacks trees of all sizes and ages. Seedlings may be killed in a relatively few years following infection because the rust can enter through needles attached directly on the main stems. A longer time is required to kill older trees, however, for the fungus characteristically enters their trunks via branches (fig. 3). The fungus progresses down the branch at the rate of only a few inches per year. The farther away from the trunk branch infection occurs, therefore, the longer is the time required for invasion of the trunk.

Consequently, time elapsed between initial infection and death of the tree is sometimes 25 years and frequently considerably longer. For this reason stands of mature pines in which the rust is epidemic often

show little evidence of damage for many years. The total eventual damage to stands sometimes results from infections that took place in a few years when the weather was favorable, or even in a single such year, during a long period.

Stand damage differs greatly in intensity, depending on the degree of susceptibility of the pine species, the climate, and the proximity and abundance of alternate host plants. Under environmental conditions favorable for the fungus, stands of ponderosa and lodgepole pines may be largely or entirely destroyed over limited areas. Heavy infection has been found in lodgepole pine stands where the closest *Comandra umbellata* plants were more than a mile away.

Alternate Host Plants

Comandra umbellata is highly susceptible to the rust. It is widespread in the United States and southern Canada but is somewhat restricted in local occurrence because of its habitat requirements. This herbaceous perennial has long underground runners or rhizomes. It is parasitic on roots of numerous plant species, and is rather commonly found in association with sagebrush. *C. umbellata* is occasionally found in very open pine stands, but does not grow in denser stands. Its preferred habitat is dry open ground, and it increases on range lands that have been overgrazed and abused. The plant has practically no forage value and even when abundant is rarely eaten on open range lands by livestock and wildlife. Grazing therefore has little effect on the normal reproductive processes of toadflax.

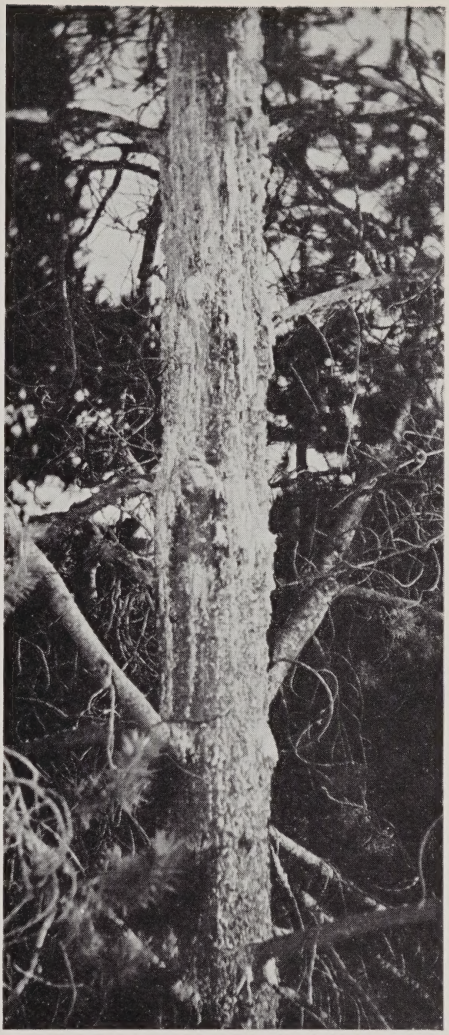

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Figure 4.—A trunk canker on a large lodgepole pine exudes abundant resin. Resinosis is a conspicuous and common symptom of the rust on this host. Aeciospores are rarely produced on such cankers probably because the bark is thick.

Comandra livida is found mainly from Alaska to Newfoundland and is relatively rare in Northern United States. It grows in moist soils. Little is known about its degree of susceptibility to the rust.

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Figure 5.—Comandra rust cankers on lodgepole pine. Porcupines and other rodents commonly feed upon infected bark. Flow of resin usually increases as a result of the wounds.

Control

No method for control of comandra blister rust has yet been developed. Grubbing out the alternate host plants has not proved successful because of the difficulty of complete eradication of the extensive underground parts. Numerous herbicides have been tested, but none has yet effected a satisfactory kill of *Comandra umbellata*. It is an intermediate plant, appearing in the succession when pioneer plants die out. There is evidence that *C. umbellata* can be largely eliminated from abused range lands by regulating grazing and restoring grasses and other plants in the ground cover.

Timber cutting operations should be concentrated in heavily diseased stands wherever possible. Removing infected trees is not only a sanitation measure, it also enables salvaging merchantable trees before they die and deteriorate from decay

and other causes. Crop trees in infected stands of young ponderosa pine should be carefully examined for infections when selected during thinnings or other improvement cuttings, because undetected infections would eventually kill the selected trees.

References

HOST RELATIONSHIPS AND DISTRIBUTION OF CONIFER RUSTS IN THE UNITED STATES AND CANADA. J. S. BOYCE. Conn. Acad. Arts and Sci., Trans. 35: 329–482. 1943.

FOREST PATHOLOGY. J. S. BOYCE. Ed. 2, 550 pp. 1948.

A DISEASE OF PINES CAUSED BY CRONARTIUM PYRIFORME. G. G. HEDGCOCK and W. H. LONG. U.S. Dept. Agr. Bul. 247, 20 pp. 1915.

THE COMANDRA BLISTER RUST IN LODGEPOLE PINE. JAMES L. MIELKE. U.S. Forest Serv. Intermountain Forest and Range Expt. Sta. Res. Note 46, 8 pp. 1957.

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U.S. GOVERNMENT PRINTING OFFICE: 1961